Enumeration of Adult Chum Salmon, *Oncorhynchus keta*, in the Fishing Branch River, Yukon Territory, 1997

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by

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ABSTRACT

Boyce, I. and P. Vust. 2002. Enumeration of adult chum salmon, *Oncorhynchus keta*, in the Fishing Branch River, Yukon Territory, 1997. Can. Manuscr. Rep. Fish. Aquat. Sci. 2585: 35 p.

A total of 26,968 migrating adult chum salmon (Oncorhynchus keta) was enumerated at a weir on the Fishing Branch River from August 28 to October 15, 1997. The run was estimated to be 51.6% female (n=26,968), and 38.0% age-4_1, 54.1% age-5_1, 7.7% age-6_1 and 0.2% age 7_1 (n=618). Fork length (mm) averaged 676 for males and 624 for females (n=800). A total of 175 spaghetti tags was observed. Tag loss was not identified conclusively. A sample of fish that drifted downstream onto the weir was 37.2% age-4_1, 56.6% age-5_1, 6.2% age-6_1 (n=129), and 38.5% female (n=130). Estimated expenditure of milt/eggs in these fish averaged 92.3% for males (n=80, st. dev.=15.1%) and 90.6% for females (n=50, st. dev.=13.6%). Twelve chinook and eight coho salmon were observed. Water temperature ranged from 7.5°C to 1.5°C; level fluctuated by 0.2 m.

RÉSUMÉ

Boyce, I. and P. Vust. 2002. Enumeration of adult chum salmon, *Oncorhynchus keta*, in the Fishing Branch River, Yukon Territory, 1997. Can. Manuscr. Rep. Fish. Aquat. Sci. 2585: 35 p.

Du 28 août au 15 octobre 1997, un total de 26 968 saumons kétas adultes migrateurs (*Oncorhynchus keta*) ont été dénombrés à une bordigue installée dans la rivière Fishing Branch, au Yukon. Le pourcentage de femelles dans la remonte a été estimé à 51,6 % (n = 26 968), dont 38,0 % étaient d'âge 4_1, 54,1 % d'âge 5_1, 7,7 % d'âge 6_1 et 0,2 % d'âge 7_1 (n = 618). La longueur moyenne à la fourche des mâles et des femelles (n = 800) se chiffrait à 676 mm et 624 mm, respectivement. Un total de 175 étiquettes en spaghetti ont été relevées. La perte d'étiquettes n'a pas été irréfutablement établie. Un échantillon de saumons qui avaient dérivé vers l'aval et entré dans la bordigue se composait de 37,2 % d'âge 4_1, 56,6 % d'âge 5_1 et 6,2 % d'âge 6_1 (n = 129), les femelles y étant représentée à 38,5 % (n = 130). L'émission estimative de laitance et d'oeufs chez ces individus se chiffrait en moyenne à 92,3 % chez les mâles (n = 80, ET = 15,1 %) et 90,6 % chez les femelles (n = 50, ET = 13,6 %). Douze quinnats et huit cohos ont aussi été identifiés. La température de l'eau allait de 7,5 à 1,5 °C tandis que le niveau fluctuait de 0,2 m.

INTRODUCTION

Chum salmon (*Oncorhynchus keta*) native to the south fork of the Fishing Branch River have been enumerated annually since 1971. From 1972 to 1975, 1985 to 1989, and 1991 to 1997 a weir was used; in other years, escapement was estimated using aerial counts (JTC 1997b). Field operations and administration for the enumeration program have been conducted by Fisheries and Oceans Canada (DFO) in co-operation with the Vuntut Gwitchin First Nation (VGFN).

The 1997 Fishing Branch River weir project supported the Upper Yukon River fall chum salmon mark-recapture project, a co-operative study involving the U.S. National Marine Fisheries Service (NMFS), the U.S. Fish and Wildlife Service (USFWS), the Alaska Department of Fish and Game (ADF&G) and DFO. The objective of the project was estimate the number of chum salmon migrating past Rampart, Alaska and to study the distribution of fall chum salmon stocks throughout the upper Yukon River drainage basin. In 1997, approximately 18,600 spaghetti tags were applied at Rampart Rapids, approximately 50 km downstream of the village of Rampart. Two fishwheels were used to capture the fish for tagging – one adjacent to each bank of the river. Different coloured tags were used to identify the capture fishwheel (Underwood et al 1999).

OBJECTIVES

The specific objectives of the 1997 Fishing Branch chum enumeration program were as follows:

1. to enumerate, by species and sex, all adult salmon passing the weir site;

2. to assess age and size composition by sex, and spawning success, of Fishing Branch River chum salmon;

3. to document hydrological conditions (temperature and level); and

4. to collect data relating to the tagging project at Rampart, Alaska by:
   - enumeration of spaghetti tags observed by colour;
   - capture of spaghetti-tagged fish when practicable;
   - documentation of spaghetti tag identification numbers; and
   - close examination of 1,000 fish per week in order to determine conclusively presence or absence of a pelvic fin-clip or tagging needle mark, so as to assess spaghetti tag loss rates.

WATERSHED DESCRIPTION

Located in the northern Yukon Territory, the south fork of the Fishing Branch River is a headwater tributary of the Porcupine River, itself a major tributary to the Yukon River. The Fishing Branch River flows northeast out of the Ogilvie Mountains, draining an area of approximately 1700 square kilometres (NTS 116 J.K E 1/2, Department of Mines and Technical Surveys 1959). The south fork joins the north fork near Bear Cave Mountain and flows into the Miner River, a tributary of the upper Porcupine River (Figure 1). The spawning area on the Fishing Branch River is approximately 2,600 km from the Bering Sea (Bergstrom 1991).

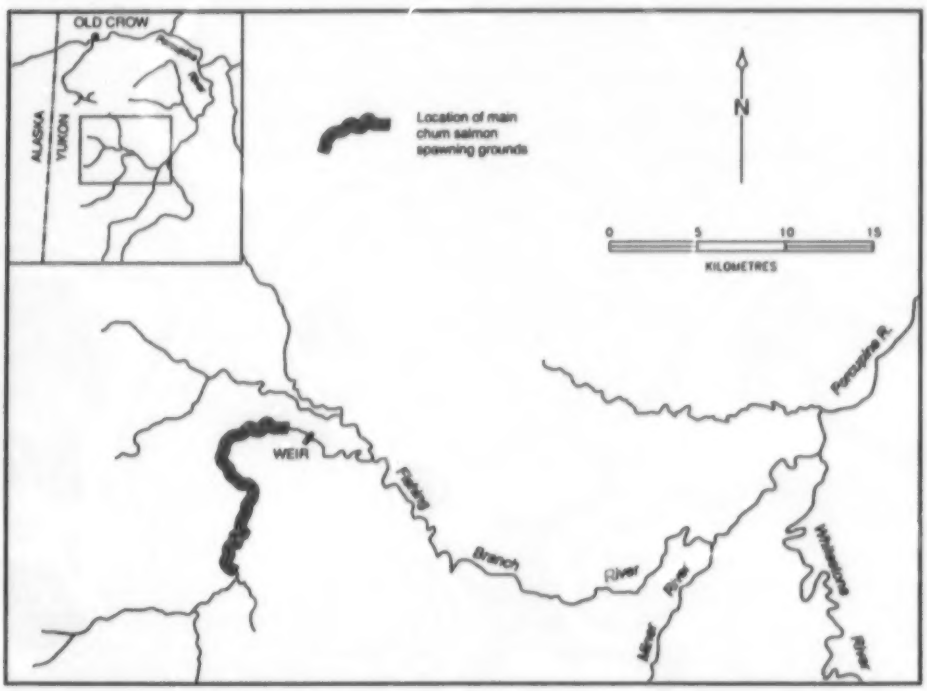

FIGURE 1. MAP OF THE WEIR SITE ON THE FISHING BRANCH RIVER.

The terrain in the Fishing Branch River watershed includes rolling hills with elevations generally below 450m with some mountains up to 1000m. Muskeg often extends to the riverbank. Trees include black and white spruce, willow and birch. There are ponds and thermokarst basins in the region, but no lakes (Oswald and Senyk 1977).

The closest climatological station to the Fishing Branch River is in Old Crow, approximately 120 km to the north of the weir site. Temperatures recorded at the station during the period 1968-

1990 averaged -9.3 °C and ranged from -59°C to 32 °C. The mean annual precipitation during this period was 239.5mm. (Environment Canada files).

The main channel of the Fishing Branch River is clear, swift, and meandering with riffles, large exposed gravel bars and pools up to 2.5m deep. The streambed is made up of large cobble (50-250mm) and medium cobble (2-50mm) (Bryan 1973). Side channels are slow and have fine granular sediment over medium cobble (Bruce 1975).

Stream discharge fluctuates greatly due to regional precipitation and the spring snowmelt. Flood-like conditions in the summer and fall after rainfall are not uncommon. Available flow measurements at the weir site range from 11.3 cubic metres per second in March 1972 (Steigenberger 1972) to 56.6 cubic metres per second in September 1972 (Elson 1975). A 15 km stretch of groundwater discharge in the headwaters of the south fork of the Fishing Branch River maintains open water in winter many kilometres downstream. The weir site is in the open water area.

FISHERIES RESOURCE OVERVIEW

Species Present

The south fork of the Fishing Branch River is a major spawning ground for fall chum salmon[1]. Estimates of escapement have ranged from 15,150 to 353,282 chum salmon (JTC 1997b and Elson 1976). Spawning occurs from September to November. The groundwater flow provides a habitat suitable for spawning adults, incubating eggs and rearing juveniles when temperatures in the region are well below freezing (Steigenberger 1972).

Coho salmon (O. kisutch) spawn in the same area in October and November. Bryan (1973) reported that 150 coho juveniles were seined in a 300 square metre shallow riffle area of the Fishing Branch River in March 1972 and 12 were caught in a seine in May 1972. Low numbers of adult coho salmon have been enumerated at the weir. However, total escapements are unknown since the weir is removed before the coho migration is believed to be complete, because of weather conditions.

In July and August, chinook salmon (O. tshawytscha) also spawn in the groundwater area (Steigenberger, et al 1973). Low numbers of adult chinook have been observed at the weir and it has been suggested that the majority of the escapement each year occurs prior to weir installation. However, this was not supported by observations made in 1998 (Doehle 1999, Boyce and Wilson 2001).

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[1] Chum salmon in the Yukon River system can be separated into two major groups: fall (or autumn), and summer. Fall chum can be distinguished from summer chum as adults by: (1) later entrance into freshwater, (2) less developed reproductive systems at the time of entry into freshwater, (3) a later spawning period, (4) larger size, and (5) greater fecundity (Groot and Margolis 1991).

Non-salmon species present in the area include: slimy sculpin (Cottus cognatus), round whitefish (Prosopium cylindraceum), Arctic grayling (Thymallus arcticus), and burbot (Lota). Northern pike (Esox lucius), humpback whitefish (Coregonus clupeaformis) and broad whitefish (Coregonus nasus) have also been noted at the weir site, and in the lower limits of the Fishing Branch River (Steigenberger et al 1973).

Non-Human Utilisation

Grizzly bears, wolves and eagles, among other mammals and birds are known to be supported in part by the salmon stocks of the Fishing Branch River.

In a 6.5 km reach located in the vicinity of the weir site, the grayling population has been estimated to be 9,000 fish (Bruce 1973). In that study, stomach content analyses showed that the grayling diet included chum eggs and alevins. Other fish species native to the Fishing Branch River are believed to prey upon chum salmon eggs, alevins, and fry.

Human Utilisation

Fishing Branch River salmon are harvested in Canada by the VGFN on the Porcupine River near Old Crow, and in Alaskan subsistence and commercial fisheries along the length of the Yukon River in the United States. They may also be intercepted in the United States groundfish trawl fisheries in the Bering Sea-Aleutian Islands area and the Gulf of Alaska, in purse seine and salmon gillnet fisheries in the "False Pass" area near the south Alaska Peninsula, and in coastal gillnet fisheries in Norton Sound. Until 1992, Fishing Branch River salmon may have been harvested in other off-shore fisheries, namely:

1. the Japanese high-seas mothership and land-based salmon gillnet fisheries;
2. the high-seas squid gillnet fisheries in the North Pacific Ocean of Japan; the Republic of Korea, and the Republic of China (Taiwan);
3. the foreign groundfish fisheries of the Bering Sea and Gulf of Alaska;
4. the joint-venture groundfish fisheries of the Bering Sea and Gulf of Alaska; and
5. the groundfish trawl fishery by many nations in the "Doughnut Hole" international waters area of the Bering Sea.

These fisheries harvested large numbers of salmon some of which were likely of Yukon River origin, and therefore potentially of Fishing Branch River origin. However, several of the offshore fisheries have been phased out by international agreements (JTC 1993c).

METHODS

WEIR LOCATION AND CONSTRUCTION

The weir was installed on the south fork of the Fishing Branch River approximately 31 km west of the Miner River confluence (Figure 1). The location has not varied since a weir was first installed on the Fishing Branch River in 1972. Approximate co-ordinates are 66°32′ north and 139°15′ west (NTS map reference 116JK 1:50,000).

Materials and methods used to construct the weir were similar to those used since 1985. Photographs of the structure are presented in Boyce 2001. Components included approximately 15 iron tripods, plywood/angle-iron stringers, electrical conduit, Vexar™[2] (plastic screening) and sandbags. A sampling chamber, constructed from rebar, angle-iron stringers, and conduit was placed where flow was the greatest (close to the middle of the river). This formed the apex of the weir. Tripods were placed out at a slight angle downstream from the sampling chamber to each bank of the river. The distance between tripods was 3m (10ft.). Tripods were interconnected by pairs of horizontal stringers that were bolted approximately one quarter and three quarters of the way up from the bottom of the upstream leg of each tripod. Conduit inserted at 5 cm (2") centres through the stringers provided the actual barrier to fish migration. Conduit was also inserted into the sampling chamber frame at the upstream end and sides. There was no gate at the downstream end of the chamber. Fish passage through the weir was made possible by removal of two or three pieces of conduit from the upstream end of the chamber. (This opening is hereafter referred to as the "gate".) A platform, supported by the weir itself and rebar driven into the river bottom, was placed by the side of the sampling chamber to permit enumeration and sampling.

Vexar™mesh was laid out along the lower portions of the conduit to further stabilise and seal the weir. Approximately 120 burlap bags filled with gravel were used to hold the Vexar™ in place and help anchor the structure.

Lighting consisted of approximately fourteen floodlights (100 and 150 watt) strung across the weir and within the camp, to facilitate night counting and to provide safe conditions for personnel. A gasoline-fuelled generator was used as the power source.

Weir construction was completed on August 27 at 1500hrs.

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[2] Mention of trade names does not constitute endorsement.

ENUMERATION

Weir

Enumeration commenced at noon on August 28.

Migrants were counted at the upstream end of the sampling chamber as they swam through the open gate, or were manually transported over the closed gate using a dip-net. Approximately 23% of the run was handled in order to estimate its age and size composition, recover spaghetti tags, and determine the rate of tag-loss[3] (Appendix 5.2).

Generally fish passage or transport occurred 24 hours per day. Exceptions to this occurred during early morning hours at the end of September and in October when salmon abundance was deemed justifiably low, and when enumerators were performing other activities such as sampling carcasses. This amounted to a total of 118 hours over the course of the season (Appendix 1.0).

Enumeration ceased at 1300 hours on October 15. The weir was removed on October 17.

Aerial survey

There was no aerial survey flown in 1997 (see Discussion).

BIOLOGICAL SAMPLING

The chum salmon escapement was sampled in order to obtain age and length data by sex for the run. Fish were retrieved from the sampling chamber with a dip-net and placed in an aluminium tub containing river water. Using forceps, three scales were removed from the preferred area (located above the lateral line on an imaginary line extending from the posterior end of the dorsal fin to the anterior end of the anal fin). Fork length was measured to the nearest 5mm using a flexible plastic tape measure. Sex was recorded. After sampling, fish were placed in an in-river recovery pen from which they could exit freely.

A total of 800 live fish were sampled for age-length-sex data. This exceeded the target of 750 fish, which was based on the number of samples required to characterise a population of approximately 100,000 fish having three age classes, with 95% confidence and +/- 5% precision (DFO files; from Cochran 1977). It was assumed that approximately 30% of the scales would be uninterpretable due to resorption. An attempt was made to sample in proportion to run timing;

---

[3] On each fish that was tagged at Rampart Rapids, Alaska a portion of the left pelvic fin was clipped. Tag loss could be conclusively identified by the presence of such a clip, in association with a tagging needle mark. Fish were examined for pelvic fin clips as they were dip-netted over the Fishing Branch weir gate,

however this was somewhat difficult due to the challenge of predicting the total escapement, given interannual variation in timing.

Data and samples were also collected from carcasses of chum salmon that had drifted onto the weir from an upstream location, either deceased or in a moribund state. Sex, post-orbital hypural (POH) length, and fork length were recorded. Ten scales were removed from each fish. The number of scales removed from carcasses was greater than the number removed from live samples since handling time was not a concern, and it was expected that scale resorption would be a greater problem. Pectoral fins, otoliths and vertebrae were also collected. The gonads in each carcass were examined visually in order to assess spawning success. The amount of reproductive material observed was expressed as a percentage of what was estimated to have been present prior to spawning. Pre-spawn fish were not examined for comparison purposes.

The primary objective of the carcass sample was to augment the live fish sample. Bony structures assisted in the interpretation of scale patterns by providing insight on resorption rates. On sexually mature fish that have migrated large distances without feeding, bony structures provide more reliable age data than scales, since they do not appear to be subject to the same degree of resorption. The two length measurements were taken in order to allow inference of POH length on live fish. POH length is more difficult to measure than fork length on living fish; however it is often a more useful estimator of size since it is not influenced by the changes in morphology that chum salmon exhibit as they approach sexual maturity (primarily kype development). A total of 130 carcasses were sampled in 1997.

HYDROLOGICAL DATA

Water temperature and level was recorded every four hours, with some interruptions. Temperature (°C) was taken from the platform adjacent to the sampling chamber using a hand-held alcohol thermometer. The temperature within the top six inches of the water column was measured.

A staff gauge was positioned close to the south bank of the river approximately five metres downstream from the weir. Placement may have varied slightly from other years of the study. The function of the gauge, which was not zeroed or placed in the deepest section of the river, was to allow tracking of water level fluctuation throughout the 1997 enumeration period.

AGE ANALYSIS AND DATA STORAGE

Scales, pectoral fins, otoliths, and vertebrae were sent to the Fish Ageing Lab at the DFO Pacific Biological Station in Nanaimo, B.C. for age analysis.

Raw data were transcribed into Microsoft® Excel and stored at the DFO office in Whitehorse, Y.T.

RESULTS

ENUMERATION

Weir Count

A total of 26,968 adult chum salmon were observed passing the weir site in 1997 (Appendix 2.0). Significant numbers of fish were observed as soon as counting commenced; 433 fish in the first 48 hours. However, counts of greater than 1,000 fish were not obtained until the weir had been in place for 12 days. It is unlikely that many chum salmon passed the weir site after enumeration ceased since the fewer than 100 fish were observed on each of the five days preceding weir removal.

The 1997 chum run appeared to have a number of peaks, decreasing in magnitude over time (Figure 2). The highest daily counts, 1,487 and 1,490 fish, were recorded on September 10 and 11 respectively. The run mid-point was observed on September 17.

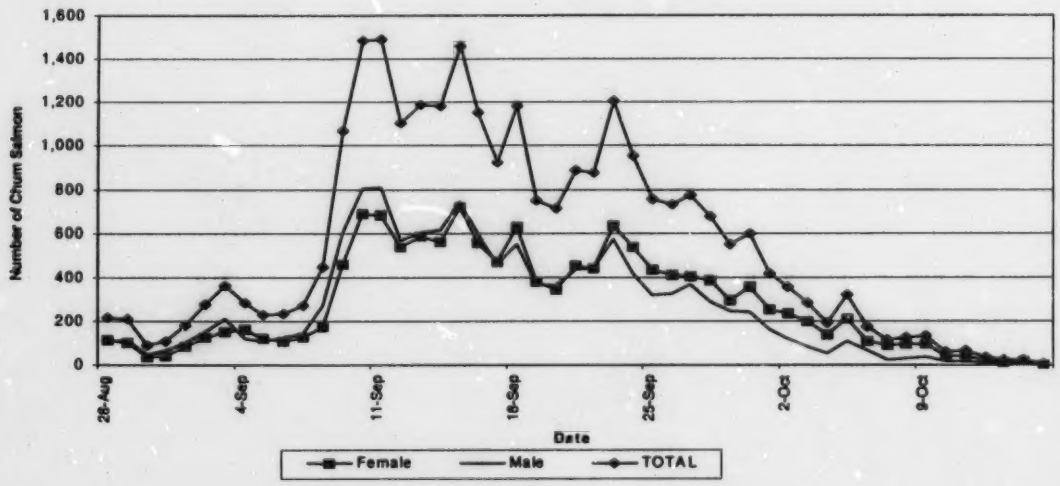

FIGURE 2. DAILY COUNTS OF CHUM SALMON THROUGH THE FISHING BRANCH RIVER WEIR, 1997.

Hourly counts are presented in Appendix 3.0 and Appendix 3.1. Note that the count recorded for a given hour represents the number of migrants through the weir between the beginning and end of that hour. Figure 3 depicts diel run timing averaged over the course of the observed run. (The numbers of fish that passed through the weir at a specific time each day were summed and divided by the number of days.) Certain days were censored, specifically those on which fish passage was completely halted for more than one hour[4] or there was a count of fewer than 500

[4] i.e. when the gate was closed and no fish were manually transferred over the gate.

fish. (Variability in diel run timing appeared to increase substantially on days with very low weir passage rates.) The average hourly counts suggest that 1800 hrs and 2000 hrs to midnight were the favoured times for fish passage. However, variability was high (Appendix 3.2).

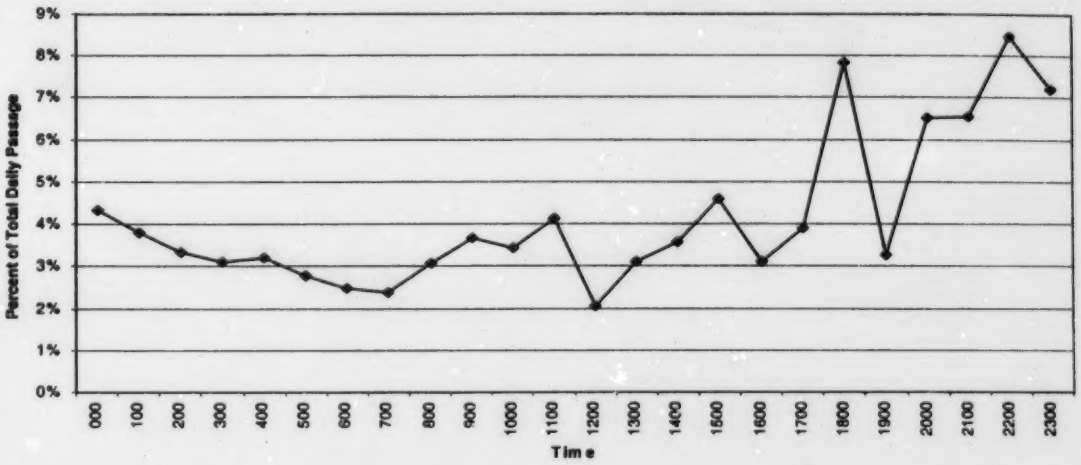

FIGURE 3. AVERAGE DIEL RUN TIMING OF CHUM SALMON THROUGH THE FISHING BRANCH RIVER WEIR, 1997.

The number of upstream migrants identified as female was 13,905. Females accounted for 51.6% of the total count of chum salmon. As illustrated in Table 1., the female contribution to the count was greatest at the end of the run. The weekly female contribution ranged from a minimum of 46.1% (n= 7,059) in statistical week (SW) 37, to a maximum of 69.8% (n=994) in SW 41.

TABLE 1. WEEKLY COUNTS BY SEX OF CHUM SALMON AT THE FISHING BRANCH RIVER WEIR, 1997.

Stat Week	Week Ending	Male	Female	Total	% Female
35	30-Aug	270	252	522	48.3%
36	6-Sep	879	801	1,680	47.7%
37	13-Sep	3,806	3,253	7,059	46.1%
38	20-Sep	3,698	3,662	7,360	49.8%
39	27-Sep	2,879	3,313	6,192	53.5%
40	4-Oct	1,201	1,870	3,071	60.9%
41	11-Oct	300	694	994	69.8%
42	18-Oct	30	60	90	66.7%
TOTAL		13,063	13,905	26,968	51.6%

Twelve chinook salmon and eight coho salmon were observed migrating through the weir in 1997 (Appendix 4.0). The chinook were observed between August 30 and September 13,

inclusive. One was male; the gender of the others was not identified. The coho were observed from October 8 to October 14, inclusive. Gender was identified on three of the coho, all of which were male. Two chinook carcasses drifted onto the upstream side of the weir – a female on September 14, and a male on September 17. Whitefish and arctic grayling were also observed at the weir site.

Tag Data

A total of 175 spaghetti tags were observed at the weir; 137 of these were white and the rest were yellow (Appendix 5.0). Forty-one tags were recovered (including two from fish that drifted downstream on to the weir). All tags recovered had been applied at Rampart Rapids, Alaska. Tag application dates and migration rates are presented in Appendix 5.1. On average, 33.4 days elapsed (n=39; std. dev.=4.0) between the tag application and tag recovery events. This translates to an average migration rate of 42.3 km/day[5] (std. dev.=4.6) assuming that each fish resumed its migration immediately after tag application and was captured immediately upon arrival at the weir.

A total of 6,156 fish were examined for spaghetti tag loss (Appendix 5.2). Of these fish, 37 possessed tags. Two fish with severed left pelvic fins were observed. On one of these fish no tagging needle mark was apparent, and the severed fin did not appear to have been a human clip. Therefore, it is unlikely that this fish had been tagged. On the other fish, recovered early in the study, presence/ absence of a tagging needle mark was not documented; therefore it is not possible to state conclusively that the fish had been tagged. Therefore the rate of tag loss observed ranged from 0% to 2.6%.

3.2 BIOLOGICAL SAMPLING

Live Fish

Sampling effort in relation to run timing is presented in Table 2.

Fork length measurements taken from live female and male chum salmon are presented in Table 3. Also presented are POH lengths, inferred from fork lengths using the formula developed by regression analysis of lengths obtained from carcasses. The fork lengths taken from females averaged 644 mm, (std. dev.=34 mm; n=434). The fork lengths obtained from males averaged 693 mm (std. dev.=42 mm; n=366). The POH lengths calculated for females averaged 532 mm (std. dev.=25 mm). For males, POH length averaged 549 mm (std. dev.= 30 mm).

[5] Rampart Rapids and the Fishing Branch River weir are approximately 1,176 and 2,575 kilometres, respectively, from the mouth of the Yukon River (Bergstrom et al 1991).

TABLE 2. SAMPLE EFFORT IN RELATION TO RUN TIMING AT THE FISHING BRANCH RIVER WEIR, 1997.

Stat Week	Week Ending	Count	% Count	Sample	% Sample
35	30-Aug	522	1.9%	0	0.0%
36	6-Sep	1,680	6.2%	80	10.0%
37	13-Sep	7,059	26.2%	240	30.0%
38	20-Sep	7,360	27.3%	170	21.3%
39	27-Sep	6,192	23.0%	90	11.3%
40	4-Oct	3,071	11.4%	80	10.0%
41	11-Oct	994	3.7%	90	11.3%
42	18-Oct	90	0.3%	50	6.3%
TOTAL		26,968	100.0%	800	100.0%

TABLE 3. LENGTH COMPOSITION BY SEX AND AGE OF FISHING BRANCH RIVER CHUM SALMON, 1997.

Age	41		51		61		71	All Samples	
Sex	Female	Male	Female	Male	Female	Male	Male	Female	Male
N	139	96	186	155	16	25	1	434	366
Fork Length									
Ave	627	667	656	711	657	702	740	644	693
Max	515	585	550	620	595	625	740	515	585
Min	720	760	730	810	705	760	740	730	810
Var	1,021	1,346	1,059	1,362	886	781	0	1,145	1,722
Stdev	32	37	33	37	30	28	0	34	42
Post-Orbital Hypural (POH) Length									
Ave	520	530	541	562	542	555	582	532	549
Max	439	472	464	497	497	500	582	439	472
Min	588	597	595	632	577	597	582	595	632
Var	543	684	563	692	471	397	0	609	875
Stdev	23	26	24	26	22	20	0	25	30

* includes unaged fish.

Of the 800 chum salmon scale samples taken from live fish and sent to the morphology lab for analysis, 618 (77.3%) yielded age data. Of the remaining samples, 154 (19.3% of total) were resorbed, 13 (1.6%) were regenerated and 15 (1.9%) had been mounted incorrectly on the scale cards. Age results for each week were expanded by the weir count, with each sex treated separately (Table 4). The estimated age composition for the run was as follows: 38.0% age-4_1, 54.1% age-5_1, 7.7% age-6_1, and 0.2% age-7_1. Data by statistical week are presented in Appendix 6.

TABLE 4. AGE COMPOSITION OF FISHING BRANCH CHUM SALMON, 1997.

		Age Class				
	N	31	41	51	61	Total
Male	277	39.4%	50.7%	9.4%	0.5%	100%
Female	341	37.5%	56.4%	6.2%	0.0%	100%
Combined	618	38.0%	54.1%	7.7%	0.2%	100%

Carcasses

Age and size data collected from the carcasses of fish that drifted downstream on to the weir is presented in Appendix 7. Estimates of the expenditure of eggs or milt in individual carcass samples were somewhat variable, averaging 92.3% (std. dev.=15.1%; n=50) for females and 90.6% (std. dev.=13.6%; n=80) for males. All carcasses sampled showed evidence of at least some release of eggs or milt.

Linear regression was used to determine the relationship between fork length and POH length. Females and males were treated separately. The relationship for both females and males was significant at $p_{critical}=0.05$. The equation developed for females was: $a = 0.73b + 63$, where a = *fork length* and b = *POH length* (df=48; r-square=0.81). Likewise, the equation developed for males was $a = 0.71b + 55$ (df=73; r-square=0.84).

HYDROLOGICAL DATA

Water temperature readings are presented in Appendix 8. The range observed over the course of the season was 6.0°C. The maximum temperature recorded was 7.5°C (August 29), while the minimum was 1.5°C (October 12). Readings taken at 2000 hrs each day are presented in Figure 4.

The highest water level reading was 0.5 m (Appendix 9.0). This was also the first reading taken (August 28, noon). Levels decreased rapidly for the next four days, stabilised for about two weeks, and then declined gradually for the remainder of the season. Fluctuation over the measurement period was 0.2m. Figure 5 presents the water level readings at 2000 hrs each day. Note that levels do not reflect the absolute depth of the river as the gauge was not zeroed or placed in the deepest section of the river.

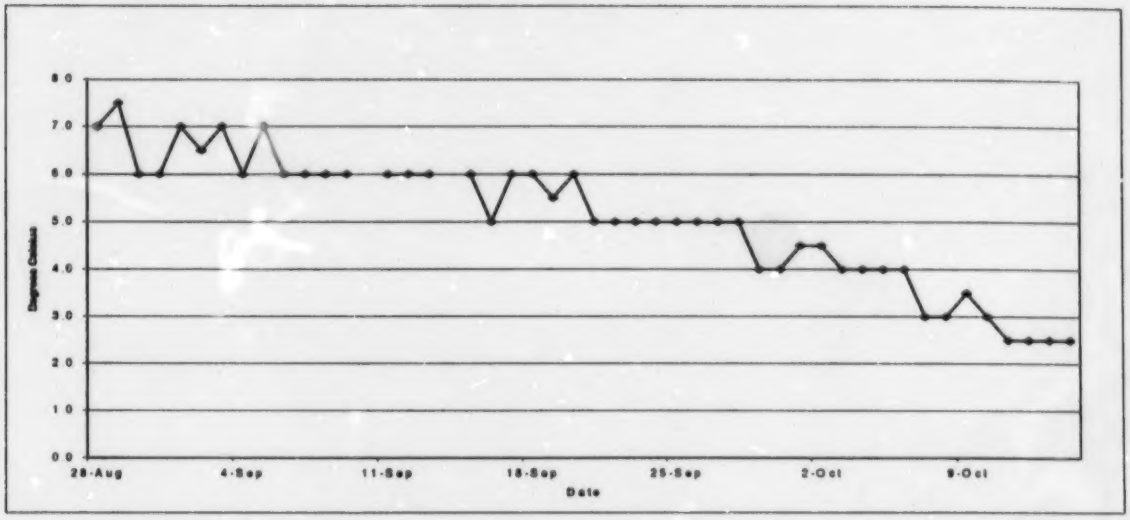

FIGURE 4. DAILY WATER TEMPERATURES RECORDED AT FISHING BRANCH RIVER WEIR, 1997.

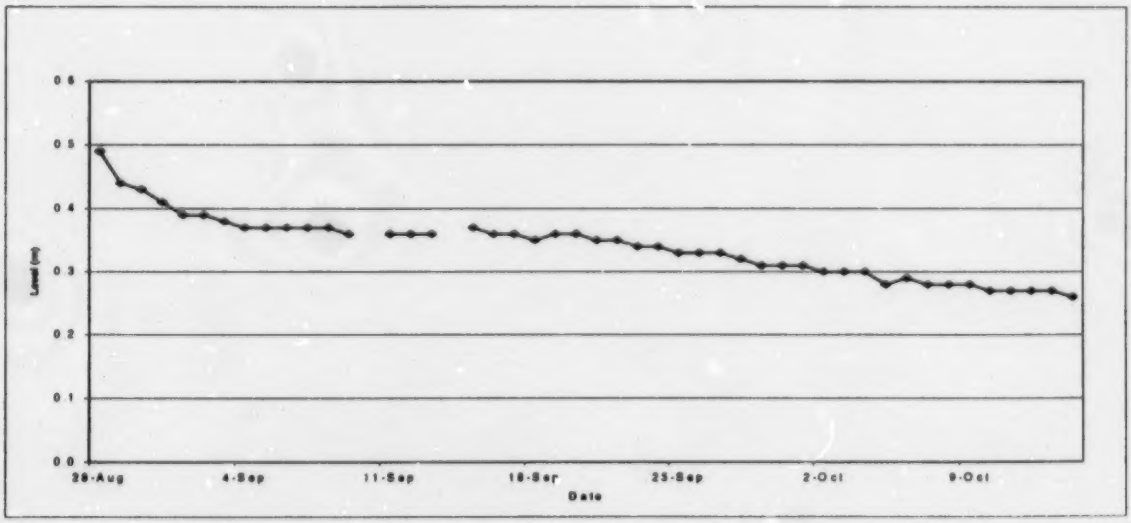

FIGURE 5. DAILY WATER LEVEL READINGS TAKEN AT THE FISHING BRANCH RIVER WEIR, 1997.

DISCUSSION

The Fishing Branch River weir count was 52% lower than the 1993–1996 average of approximately 56,000 chum salmon (Appendix 10). It was well below the lower end of the interim escapement objective range of 50,000 to 120,000 chum salmon, which was established through the Canada/U.S Yukon River Salmon Negotiations.

Run timing through the weir appeared normal, although the observed peak occurred somewhat early relative to average. The mid-point was September 17; in comparison the 1993-1996[6] average was September 20. The peak count date (September 11) was nine days earlier than average.

The contribution of females to the escapement (52%) approximated the recent cycle average (53%). The slight predominance of females observed at the weir most years may be a factor of gear selectivity in downstream fisheries. Males may be more susceptible to entanglement in gillnets because of their more pronounced snouts and teeth, particularly as they approach maturity (Milligan et al, 1986). Since fish were not handled to determine gender, there was potential for error from observer bias, and poor visibility of individual fish due to high densities, low water clarity and light conditions. Comparisons were made with the sex composition in the sample for age and length data, in which all fish were closely inspected. The pooled sample (n=800) was 55% female, within 2% of the estimated run sex composition. Although the potential existed for mis-identification of fish that were not handled[7] due to observer bias, water clarity and light conditions, other possible causes for the slight difference observed are errors resulting from sampling rate, timing, and method (gender bias in sample selection).

The fact that the carcasses sampled contained only small amounts of reproductive material suggests that most of the population spawned successfully.

The mark rate of 0.6% (assuming no tag loss, 175 tags out of 26,968 fish examined) was lower than observed at downriver locations. This coincides with observations made in 1996. Although is not possible to state conclusively that there was no loss of tags (from fish marked at Rampart Rapids, Alaska) observed at the Fishing Branch River weir, the incidence of tag loss was at most minor. A similar study in Fort Yukon involving fishwheels found no loss of tags. It appears that tag loss is not the reason for an apparent decline in mark rate with distance from the tagging site (JTC 1997b).

As mentioned previously on page 6, "ENUMERATION, Aerial Survey", no aerial enumeration was conducted in 1997. Over the years, the relationship between aerial survey counts and weir counts has been quite variable. This indicates that aerial enumeration is a poor substitute for a weir count. Prior to 1990, for years when there was no weir installed, aerial survey results were

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[6] This period was chosen because it represents the most recent cycle; the predominant age of spawning Fishing Branch River chum is four years.

[7] The likelihood of mistaking the gender of an individual fish sampled for age and length data is considered to have been negligible.

expanded by a factor of 2.71 to estimate escapement. In 1990, an expansion factor of 3.57 was used (JTC 1993c). Variability in aerial survey results can be due to differences in observer efficiency, water depth, clarity, and spawner density, run timing, and environmental factors. The density of spawners, their colouration, and the low light levels often experienced in September/ October in the area make aerial surveys of the Fishing Branch River particularly challenging.

It was expected pre-season that an above-average number of Fishing Branch River-origin chum salmon would enter the mouth of the Yukon River in 1997. The expectation was based on an assumed productivity of 3.0 and 3.5 returns per spawner (r/s) for the principle brood years (1992 and 1993, respectively), and an expected return age composition of 71% age-four and 27% age-five. The 1997 forecast was for a return (i.e. run size) of 91,000 fish. In comparison, the run size was estimated to have averaged approximately 78,000 chum salmon from 1993-1996[8] (JTC 1997a).

The harvest of 6,294 chum salmon by the VGFN in the vicinity of Old Crow was almost double than the 1993–1996 average of approximately 3,200 fish. The U.S. harvest of Fishing Branch River-origin chum salmon, estimated using the footnoted assumptions, was 11,976 fish (DFO files). The number of Fishing Branch River-origin chum (U.S. harvest plus Canadian harvest plus escapement) that entered the mouth of the Yukon River in 1997 is therefore estimated to have been 45,238 fish, about half the pre-season projection. The harvest rate is estimated at 40%.

RECOMMENDATIONS

The weir should continue to be operated annually as it serves as the only index of chum salmon escapement in the Canadian portion of the Porcupine sub-basin of the Yukon River in Canada. The Fishing Branch River chum salmon stock is of substantial socio-economic value to the Vuntut Gwitchin First Nation. The international importance of the Fishing Branch River chum stock has also been recognised, and stock rebuilding options have been discussed (JTC 1993b).

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[8] The stock size is used here to mean the number of adult fish returning to the Yukon River from marine areas. Run size calculations are based on the following assumptions: (a) 30% of the U.S. catch is composed of Canadian-origin fish; (b) the U.S. harvests Canadian stocks in the same ratio as: upper Yukon River border escapement-to-Porcupine River border escapement; and (c) the Porcupine River border escapement consists of the Old Crow catch plus the Fishing Branch River escapement. A key assumption is that the Fishing Branch River upstream of the weir site is the only chum spawning area in the Canadian portion of the Porcupine River drainage.

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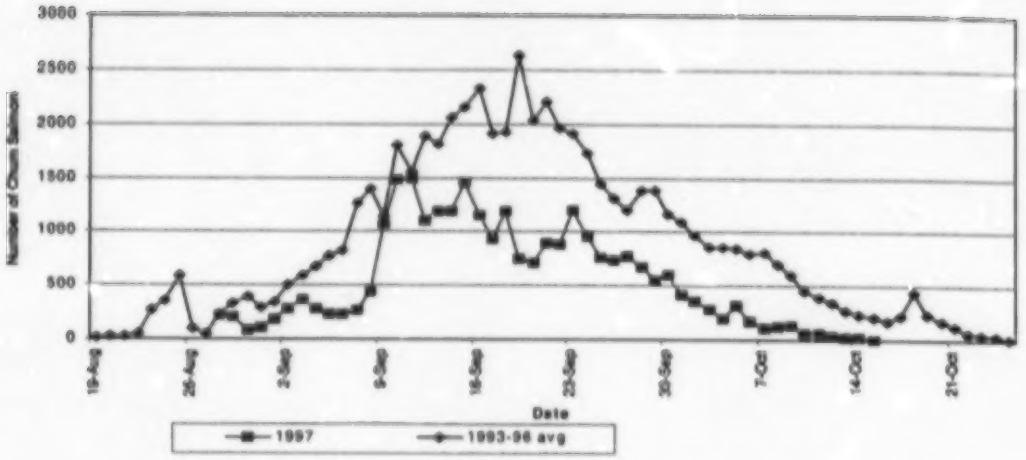

FIGURE 6. DAILY COUNTS OF CHUM SALMON THROUGH THE FISHING BRANCH RIVER WEIR, 1997 VERSUS 1993 – 1996 AVERAGE.

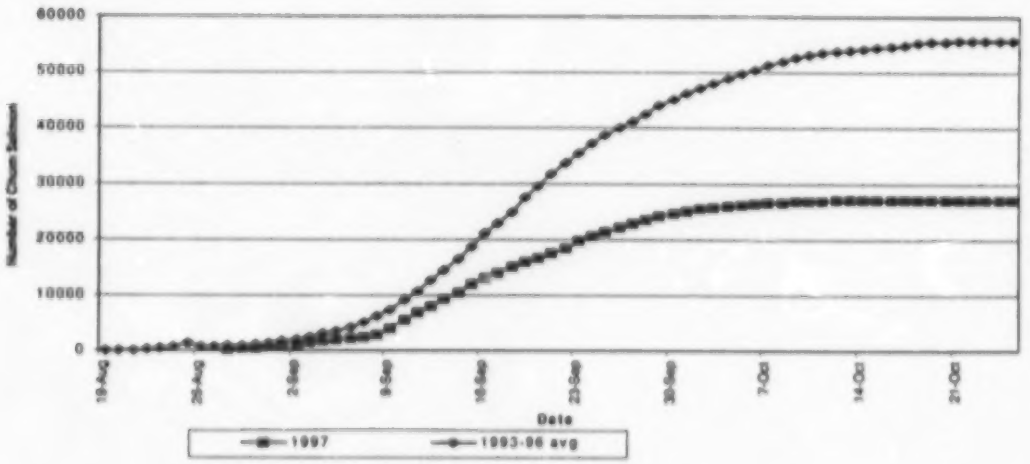

FIGURE 7. CUMULATIVE COUNTS OF CHUM SALMON THROUGH THE FISHING BRANCH RIVER WEIR, 1997 VERSUS 1993 – 1996 AVERAGE.

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Appendix 1. Fishing Branch River weir operations, 1997.

Date	Gate Closed, fish dip-netted over gate (a)		Gate Closed, fish dip-netted over gate (b)		Gate Closed, no fish dip-netted		Reasons for Closures
	Time	# Hours	Time	# Hours	Time	# Hours	
27-Aug	-	-	-	-	1500 - 2359	9	weir complete at 1500
28-Aug	-	-	-	-	2400 - 1159	12	start enumeration at noon
29-Aug	-	-	-	-	-	-	-
30-Aug	-	-	-	-	-	-	-
31-Aug	-	-	-	-	-	-	-
1-Sep	-	-	-	-	-	-	-
2-Sep	-	-	2000 - 2259	3	-	-	-
3-Sep	-	-	-	-	-	-	-
4-Sep	-	-	2100 - 2159	1	-	-	-
5-Sep	2200 - 2359	2	2000 - 2159	2	-	-	-
6-Sep	2400 - 2459	1	2000 - 2159	2	-	-	-
	2200 - 2359	2			-		
7-Sep	end 1559	8	2000 - 2159	2	-	-	-
	2200 - 2359	2	-		-		
8-Sep	2400 - 0359	4	2000 - 2059	1	-	-	-
	2100 - 2359	3			-		
9-Sep	2400 - 0359	4	2100 - 2159	1	-	-	-
10-Sep	-		1800 - 1959	2	-	-	-
11-Sep	0800 - 1059	3	1800 - 1859	1	1700 - 1759	1	unknown
	1200 - 1459	3					
12-Sep	0800 - 0959	2	1800 - 1859	1	-	-	-
	1200 - 1559	4					
13-Sep	0800 - 0959	2	1800 - 1859	1	-	-	-
	1200 - 1359	2					
	1700 - 1759	1					
	2200 - 2359	2					
14-Sep	2400 - 1659	17	1700 - 1759	1	-	-	-
	1800 - 2259	5					
15-Sep	2400 - 2459	1	1800 - 1959	2	-	-	-
	0400 - 0559	2					
	0900 - 1059	2					
16-Sep	0900 - 1059	2	1800 - 1859	1	-	-	-
	1200 - 1459	3					
	1600 - 1659	1					
17-Sep	0900 - 1059	2	1900 - 1959	1	-	-	-
	1600 - 1659	1					
	2000 - 2059	1					
18-Sep	1200 - 1359	2	1900 - 1959	1	-	-	-
	1700 - 1759	1					
	2100 - 2159	1					
19-Sep	1300 - 1459	2	1900 - 1959	1	-	-	-
	1600 - 1759	2					
	2000 - 2159	2					
20-Sep	1300 - 1759	5	1900 - 1959	1	-	-	-
	2000 - 2159	2					
21-Sep	1200 - 1859	7	1900 - 1959	1	-	-	-
	2000 - 2059	1					
22-Sep	1200 - 1459	3	1900 - 1959	1	-	-	-
	1600 - 1759	2					
	2000 - 2259	3					
23-Sep	1300 - 1359	1	1900 - 1959	1	-	-	-
	1600 - 1659	1					
24-Sep			-	-	-	-	-
25-Sep	0700 - 0759	1	1800 - 1959	2	-	-	-
	1600 - 1659	1					
	2000 - 2059	1					
26-Sep	0500 - 0759	3	-	-	-	-	-
27-Sep	0900 - 1559	7	1700 - 1759	1	0400 - 0759	4	see report text
28-Sep	0800 - 1059	3	1700 - 1759	1	0400 - 0759	4	see report text
	1200 - 1559	4					
29-Sep	0900 - 1259	4	1300 - 1459	2	0400 - 0759	4	see report text
	1500 - 1859	4					

Appendix 1 (cont'd)

Date	Gate Closed, fish dip-netted over gate (a)		Gate Closed, fish dip-netted over gate (b)		Gate Closed, no fish dip-netted		Reasons for Closures
	Time	# Hours	Time	# Hours	Time	# Hours	
30-Sep	0400 - 0759	4	1900 - 1959	1	-	-	-
	0900 - 1059	2					
	1200 - 1359	2					
	1600 - 1759	2					
1-Oct	1300 - 1459	2	1800 - 1859	1	-	-	-
	1600 - 1759	2					
	2000 - 2059	1					
2-Oct	1200 - 1459	3	1800 - 1859	1	0400 - 0759	4	see report text
	1600 - 1759	2					
	1900 - 2359	5					
3-Oct	1200 - 1759	6	1800 - 1859	1	0400 - 0759	4	see report text
	1900 - 2359	5					
4-Oct	1200 - 1459	3	1800-1859	2	0400 - 0759	4	see report text
	1700 - 1759	1			1500 - 1659	2	other duties - carcass sampling
	1900 - 2359	5					
5-Oct	1200 - 1559	4	1700 - 1759	1	0400 - 0759	4	see report text
	1800 - 2059	3			1600 - 1659	1	other duties - carcass sampling
6-Oct	1200 - 1559	4	1700 - 1859	2	0400 - 0759	4	see report text
	1900 - 2359	5			1600 - 1659	1	other duties - carcass sampling
7-Oct	1200 - 1559	4	1700 - 1859	2	0400 - 0759	4	see report text
	1900 - 2359	4			1600 - 1659	1	other duties - carcass sampling
8-Oct	1200 - 1559	4	1700 - 1759	1	0400 - 0759	4	see report text
	1800 - 2359	6			1600 - 1659	1	other duties - carcass sampling
9-Oct	0900 - 1559	7	1700 - 1859	2	0400 - 0759	4	see report text
	1900 - 2359	5			1600 - 1659	1	other duties - carcass sampling
10-Oct	0900 - 1559	7	1700 - 1759	1	0400 - 0759	4	see report text
	1800 - 2259	5			1600 - 1659	1	other duties - carcass sampling
11-Oct	0900 - 1359	5	1400 - 1559	2	0400 - 0759	4	see report text
	1700 - 2359	7			1600 - 1659	1	other duties - carcass sampling
12-Oct	0900 - 1459	6	1600 - 1859	3	0300 - 0759	5	see report text
	1900 - 2359	5			1500 - 1559	1	other duties - carcass sampling
13-Oct	0900 - 0959	1	1000 - 1559	6	0300 - 0859	6	see report text
	1800 - 1959	2	1700 - 1759	1	1600 - 1659	1	other duties - carcass sampling
	2100 - 2159	1					
	2300 - 2359	1					
14-Oct	0900 - 0959	1	1000 - 1559	6	0300 - 0759	5	see report text
	1800 - 1959	2	1800 - 1859	1	1600 - 1759	2	other duties - carcass sampling
					2000 - 2359	4	see report text
15-Oct			1200 - 1259	1	1300 - 2359	11	end enumeration
Total		279		69		118	

a) Chum examined for tag-loss only.
b) Chum sampled for age-length-sex data *and* examined for tag loss.

Appendix 2. Daily counts of chum salmon through the Fishing Branch River weir, 1997.

Date	Daily Male	Daily Female	Daily Total	Cumulative Total	Run Timing
28-Aug	107	112	219	219	0.8%
29-Aug	113	101	214	433	1.6%
30-Aug	50	39	89	522	1.9%
31-Aug	66	45	111	633	2.3%
1-Sep	101	82	183	816	3.0%
2-Sep	151	125	276	1,092	4.0%
3-Sep	210	153	363	1,455	5.4%
4-Sep	118	166	284	1,739	6.4%
5-Sep	107	120	227	1,966	7.3%
6-Sep	126	110	236	2,202	8.2%
7-Sep	144	129	273	2,475	9.2%
8-Sep	272	174	446	2,921	10.8%
9-Sep	606	461	1,067	3,988	14.8%
10-Sep	801	686	1,487	5,475	20.3%
11-Sep	808	682	1,490	6,965	25.8%
12-Sep	569	537	1,106	8,071	29.9%
13-Sep	606	584	1,190	9,261	34.3%
14-Sep	618	564	1,182	10,443	38.7%
15-Sep	743	716	1,459	11,902	44.1%
16-Sep	597	557	1,154	13,056	48.4%
17-Sep	457	468	925	13,981	51.8%
18-Sep	552	630	1,182	15,163	56.2%
19-Sep	368	380	748	15,911	59.0%
20-Sep	363	347	710	16,621	61.6%
21-Sep	435	455	890	17,511	64.9%
22-Sep	440	438	878	18,389	68.2%
23-Sep	575	631	1,206	19,595	72.7%
24-Sep	415	540	955	20,550	76.2%
25-Sep	321	434	755	21,305	79.0%
26-Sep	325	408	733	22,038	81.7%
27-Sep	368	407	775	22,813	84.6%
28-Sep	287	387	674	23,487	87.1%
29-Sep	249	298	547	24,034	89.1%
30-Sep	241	359	600	24,634	91.3%
1-Oct	162	253	415	25,049	92.9%
2-Oct	121	236	357	25,406	94.2%
3-Oct	85	198	283	25,689	95.3%
4-Oct	56	139	195	25,884	96.0%
5-Oct	107	213	320	26,204	97.2%
6-Oct	66	107	173	26,377	97.8%
7-Oct	25	90	115	26,492	98.2%
8-Oct	28	99	127	26,619	98.7%
9-Oct	35	97	132	26,751	99.2%
10-Oct	19	44	63	26,814	99.4%
11-Oct	20	44	64	26,878	99.7%
12-Oct	11	26	37	26,915	99.8%
13-Oct	10	15	25	26,940	99.9%
14-Oct	8	16	24	26,964	100.0%
15-Oct	1	3	4	26,968	100.0%
TOTALS	13,063	13,905	26,968		

Appendix 3. Hourly counts of male chum salmon through the Fishing Branch River weir, 1997.

Date/Time	000	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Total	Cum. Total
28-Aug													6	10	5	4	2	7	2	6	3	10	17	35	107	107
29-Aug	16	3	30	11	14	5	8	3	0	0	0	2	0	0	0	0	1	1	1	1	1	2	5	9	113	220
30-Aug	15	6	5	3	6	1	2	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	2	7	50	270
31-Aug	14	9	15	9	10	2	5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	66	336
1-Sep	8	13	8	4	10	3	4	2	1	0	1	1	1	0	0	0	1	1	2	1	7	10	6	17	101	437
2-Sep	26	17	9	9	11	2	3	2	0	1	1	2	0	0	0	2	0	0	5	11			17	33	151	588
3-Sep	19	19	17	17	13	0	1	0	0	1	0	1	3	0	3	3	2	4	9	4	8	15	41	30	210	798
4-Sep	16	17	5	15	4	8	1	4	1	3	1	0	0	0	0	3	1	1	2	0	5	12	10	9	118	916
5-Sep	5	13	11	6	11	5	8	4	5	1	0	1	0	4	1	0	1	4	0	0	6	6	7	8	107	1,023
6-Sep	9	9	18	7	8	9	7	5	6	1	4	2	0	3	3	1	1	1	0	3	7	6	8	8	126	1,149
7-Sep	20	8	17	3	0	7	4	10	4	1	1	4	4	2	5	1	0	0	1	10	9	8	14	11	144	1,293
8-Sep	11	11	12	5	28	20	11	14	6	1	8	2	4	7	11	9	10	10	11	15	9	18	26	13	272	1,565
9-Sep	28	26	30	18	45	38	23	42	21	22	11	7	5	18	14	8	9	10	6	11	17	12	97	88	606	2,171
10-Sep	45	54	27	32	44	26	27	21	35	23	18	20	4	19	11	10	8	23			30	144	120	60	801	2,972
11-Sep	28	32	36	56	44	35	18	21	10	14	18	24	16	12	12	35	6		29	55	56	99	101	51	808	3,780
12-Sep	35	30	31	29	1	3	1	12	13	20	29	15	13	14	19	11	28	26	18	36	75	50	19	41	569	4,349
13-Sep	45	34	25	23	30	24	27	26	14	23	35	32	12	10	16	47	26	17	13	7	52	20	22	26	606	4,955
14-Sep	20	21	30	21	19	20	17	15	36	18	31	21	34	23	35	25	19	12	30	30	24	29	27	61	618	5,573
15-Sep	30	53	42	54	6	17	15	19	35	18	8	24	40	41	34	38	11	32		14	78	41	59	34	743	6,316
16-Sep	36	24	30	15	10	20	35	19	35	22	14	31	21	25	25	46	28	3	15	40	28	25	40	10	597	6,913
17-Sep	23	11	12	24	8	15	7	14	37	23	15	25	7	19	18	22	18	35	30	13	15	14	21	31	457	7,370
18-Sep	39	22	14	1	11	18	10	16	14	35	32	26	9	13	30	22	27	26	59	10	23	16	51	28	552	7,922
19-Sep	7	6	7	8	22	10	4	6	13	11	20	23	6	18	13	19	16	11	62	5	5	12	33	31	368	8,290
20-Sep	17	13	12	6	9	8	6	5	6	21	18	18	12	6	10	8	11	12	54	5	10	21	36	39	363	8,653
21-Sep	0	10	11	7	11	15	21	8	11	17	1	9	3	8	6	4	14	6	104	8	23	50	48	40	435	9,088
22-Sep	29	13	12	12	10	11	12	9	1	16	26	28	9	10	10	60	14	13	62	6	8	11	18	40	440	9,528
23-Sep	16	13	5	4	10	13	10	7	15	29	33	29	24	19	59	44	27	53	39	4	20	40	30	32	575	10,103
24-Sep	18	19	11	6	11	13	15	9	8	30	7	18	7	25	20	20	13	17	23	20	36	20	30	19	415	10,518
25-Sep	3	7	7	25	25	13	7	10	8	13	8	34	6	6	7	7	10	20	12		29	31	24	9	321	10,839
26-Sep	5	0	4	7	12	3	1	1	8	18	43	19	9	14	12	12	11	23	12	21	43	22	13	12	325	11,164
27-Sep	11	5	10	7	0	0	0	0	15	7	22	9	6	12	11	17	22	8	50	43	31	54	12	16	368	11,532
28-Sep	7	13	11	6	0	0	0	0	10	11	7	23	12	9	15	12	13	11	27	39	19	17	16	9	287	11,819
29-Sep	7	9	9	8	0	0	0	0	20	5	11	4	4	0	5	12	9	8	11	63	21	18	12	13	249	12,068
30-Sep	2	3	8	2	1	3	9	3	12	15	1	14	4	14	17	16	6	4	68	3	12	10	10	4	241	12,309
1-Oct	4	5	9	5	4	6	4	3	4	11	9	11	6	5	7	11	5	5	4	10	9	7	7	11	162	12,471
2-Oct	8	18	6	7	0	0	0	0	1	7	12	11	4	5	4	11	8	5	1	4	4	3	0	2	121	12,592
3-Oct	6	6	4	4	0	0	0	0	3	4	4	5	9	3	5	4	1	1	3	9	6	4	2	2	85	12,677
4-Oct	2	4	1	2	0	0	0	0	2	5	9	1	4	6	3			1	5	4	2	3	0	2	56	12,733
5-Oct	7	8	2	0	0	0	0	0	2	5	9	13	4	4	7	2	0	6	19	3	8	4	3	1	107	12,840
6-Oct	4	3	2	4	0	0	0	0	2	7	3	6	11	1	4	2		7	0	2	2	3	1	2	66	12,906
7-Oct	1	3	2	1	0	0	0	0	0	1	1	3	2	1	0	1			2	4	1	0	1	1	25	12,931
8-Oct	2	2	0	1	0	0	0	0	0	1	2	2	0	1	1	4		2	4	5	0	0	0	1	28	12,959
9-Oct	3	0	1	1	0	0	0	0	0	0	5	1	2	2	5	3		5	0	2	1	2	0	2	35	12,994
10-Oct	1	2	0	0	0	0	0	0	0	0	0	2	0	2	3	2		4	0	1	2	0	0	0	19	13,013
11-Oct	0	0	0	0	0	0	0	0	0	1	0	2	0	3	3	0		2	2	3	1	1	0	2	20	13,033
12-Oct	0	0	0	0	0	0	0	0	0	0	1	0	0	2	1				2	1	1	0	2	1	11	13,044
13-Oct	1	2	1	0	0	0	0	0	0	0	0	1	1	1	1	1		0	0	0	0	0	1	0	10	13,054
14-Oct	0	0	1	0	0	0	0	0	0	1	0	1	1	0	0	1		0	2	1	0	0	0	0	8	13,062
15-Oct	0	0	0	0	0	0	0	0	0	0	0	0	1												1	13,063

Appendix 3.1. Hourly counts of female chum salmon through the Rishing River weir, 1997.

Date/Time	000	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Total	Cum. Total
28-Aug													3	5	4	1	4	5	5	2	4	8	18	53	112	112
29-Aug	23	4	12	13	17	4	7	2	0	0	1	2	0	0	0	1	0	0	0	0	0	1	5	9	101	213
30-Aug	13	5	8	1	3	1	2	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	3	1	39	252
31-Aug	7	8	6	6	8	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	45	297
1-Sep	7	7	9	0	8	2	4	2	0	0	1	1	0	0	0	0	0	0	0	3	12	7	6	13	82	379
2-Sep	15	19	8	7	9	2	1	2	1	1	0	2	1	0	1	1	1	0	7	13			7	27	125	504
3-Sep	23	11	11	7	5	2	0	2	0	1	0	0	1	0	1	2	0	5	8	3	2	9	28	32	153	657
4-Sep	19	18	14	16	8	14	1	1	0	0	1	0	0	0	0	3	0	2	6	0	2	8	30	23	166	823
5-Sep	8	26	13	6	12	10	5	0	4	1	0	0	0	1	0	0	2	2	0	0	2	2	13	13	120	943
6-Sep	8	7	25	10	12	6	5	3	2	2	1	0	1	1	1	1	0	1	0	0	4	3	9	8	110	1,053
7-Sep	20	8	14	4	0	6	11	6	0	3	4	4	2	2	4	1	0	0	2	4	7	8	9	10	129	1,182
8-Sep	10	7	9	7	27	32	7	8	0	3	1	1	1	5	1	2	6	5	11	6	5	6	9	5	174	1,356
9-Sep	24	22	13	14	52	38	12	29	5	6	3	4	3	10	9	4	4	8	6	10	16	8	72	89	461	1,817
10-Sep	50	77	31	35	40	18	16	15	11	12	7	15	4	7	11	6	18	10			16	73	134	80	686	2,503
11-Sep	40	35	35	55	40	23	9	32	6	4	10	15	3	6	9	30	9		21	38	46	75	93	48	682	3,185
12-Sep	19	43	40	22	2	2	1	5	6	12	18	19	2	13	5	13	19	31	22	42	85	55	23	38	537	3,722
13-Sep	38	40	23	21	30	16	25	28	14	14	21	18	4	8	22	43	31	16	27	11	59	28	16	31	584	4,306
14-Sep	24	33	31	22	18	20	17	13	23	12	19	22	15	33	17	17	12	18	30	26	35	30	15	62	564	4,870
15-Sep	22	59	30	28	3	25	20	17	53	17	7	25	26	19	26	46	14	35		16	88	37	61	42	716	5,586
16-Sep	42	18	23	10	6	10	32	14	34	14	7	29	14	34	23	36	18	10	15	37	46	16	53	16	557	6,143
17-Sep	44	10	16	15	5	14	11	12	29	15	13	22	15	19	24	18	7	34	27	17	10	27	29	35	468	6,611
18-Sep	47	28	25	4	11	21	17	16	17	44	27	10	10	21	27	29	34	9	46	10	25	26	75	51	630	7,241
19-Sep	7	8	7	3	14	6	6	4	11	9	15	14	6	16	7	16	15	8	67	10	15	18	66	32	380	7,621
20-Sep	20	6	5	9	13	6	12	3	4	10	13	6	6	7	19	4	14	13	67	11	10	13	26	50	347	7,968
21-Sep	0	14	10	12	14	11	6	9	9	6	1	13	5	13	8	6	11	19	105	7	28	61	48	39	455	8,423
22-Sep	43	11	7	5	13	8	9	7	2	10	28	18	4	13	6	70	11	12	51	9	8	10	38	45	438	8,861
23-Sep	12	11	5	5	6	8	11	4	13	26	25	31	19	10	77	36	24	61	47	11	46	47	60	36	631	9,492
24-Sep	15	15	7	7	12	14	11	7	8	29	9	15	9	24	13	21	12	26	54	56	60	39	54	23	540	10,032
25-Sep	4	8	10	30	14	14	14	12	2	14	15	33	4	4	5	14	21	48	18		34	55	36	25	434	10,466
26-Sep	10	0	6	3	15	10	2	2	16	17	29	16	11	12	7	20	9	23	26	41	69	31	12	21	408	10,874
27-Sep	13	6	8	10	0	0	0	0	9	6	22	9	6	18	23	9	14	17	52	54	34	64	15	18	407	11,281
28-Sep	9	10	23	10	0	0	0	0	13	24	10	35	10	16	11	18	14	9	21	56	32	24	31	11	387	11,668
29-Sep	9	14	17	8	0	0	0	0	20	5	19	6	5	0	5	14	7	8	16	41	48	26	13	17	298	11,966
30-Sep	12	8	16	6	3	1	4	4	21	29	8	28	9	15	20	19	10	13	52	7	19	20	24	11	359	12,325
1-Oct	6	14	7	4	3	6	5	6	9	14	21	14	8	9	4	6	8	8	6	40	18	14	12	11	253	12,578
2-Oct	13	20	3	10	0	0	0	0	9	11	17	23	11	19	7	25	8	19	9	15	6	5	3	3	236	12,814
3-Oct	10	17	8	5	0	0	0	0	5	12	17	9	6	5	4	16	9	14	7	16	5	10	11	12	198	13,012
4-Oct	3	5	4	4	0	0	0	0	3	12	27	12	8	4	8			3	5	18	4	6	9	4	139	13,151
5-Oct	8	8	4	5	0	0	0	0	12	14	13	15	7	12	9	5	0	4	53	9	26	0	5	4	213	13,364
6-Oct	4	5	2	0	0	0	0	0	5	10	11	8	18	4	6	4		13	0	4	6	2	1	4	107	13,471
7-Oct	6	7	1	0	0	0	0	0	2	10	7	8	3	2	4	6			18	11	1	2	1	1	90	13,561
8-Oct	2	8	1	0	0	0	0	0	1	5	8	5	3	2	4	6		8	13	16	6	4	4	3	99	13,660
9-Oct	5	7	6	3	0	0	0	0	2	3	14	8	4	5	12	6		5	0	4	3	4	2	4	97	13,757
10-Oct	3	2	0	0	0	0	0	0	0	2	5	4	4	7	3	3		3	2	0	3	2	1	0	44	13,801
11-Oct	2	0	2	0	0	0	0	0	0	3	5	0	1	2	10	0		6	5	0	2	0	2	4	44	13,845
12-Oct	2	0	0	0	0	0	0	0	0	2	2	4	2	2	3				3	1	3	2	0	0	26	13,871
13-Oct	1	0	0	0	0	0	0	0	0	1	1	1	3	1	1	1		2	1	0	0	1	0	1	15	13,886
14-Oct	0	0	1	0	0	0	0	0	0	0	1	3	0	1	2	1		0	3	4	0	0	0	0	16	13,902
15-Oct	0	0	0	0	0	0	0	0	0	0	0	0	3												3	13,905

Appendix 3.2. Diel run timing of male and female chum salmon through the Fishing Branch River weir, 1997.

Date/Time	000	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Sum	# Fish
30-Aug	31%	12%	15%	4%	10%	2%	4%	1%	0%	1%	0%	0%	1%	0%	1%	0%	0%	0%	0%	0%	0%	1%	6%	9%	100%	89
31-Aug	19%	15%	19%	14%	16%	4%	6%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	6%	100%	111
1-Sep	8%	11%	9%	2%	10%	3%	4%	2%	1%	0%	1%	1%	1%	0%	0%	0%	1%	1%	1%	2%	10%	9%	7%	16%	100%	183
29-Aug	18%	3%	20%	11%	14%	4%	7%	2%	0%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	5%	8%	100%	214
28-Aug	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	7%	4%	2%	3%	5%	3%	4%	3%	8%	16%	40%	100%	219
5-Sep	6%	17%	11%	5%	10%	7%	6%	2%	4%	1%	0%	0%	0%	2%	0%	0%	1%	3%	0%	0%	4%	4%	9%	9%	100%	227
6-Sep	7%	7%	18%	7%	8%	6%	5%	3%	3%	1%	2%	1%	0%	2%	2%	1%	0%	1%	0%	1%	5%	4%	7%	7%	100%	236
7-Sep	15%	6%	11%	3%	0%	5%	5%	6%	1%	1%	2%	3%	2%	1%	3%	1%	0%	0%	1%	5%	6%	6%	8%	8%	100%	273
2-Sep	15%	13%	6%	6%	7%	1%	1%	1%	0%	1%	0%	1%	0%	0%	0%	1%	0%	0%	4%	9%	0%	0%	9%	22%	100%	276
4-Sep	12%	12%	7%	11%	4%	8%	1%	2%	0%	1%	1%	0%	0%	0%	0%	2%	0%	1%	3%	0%	2%	7%	14%	11%	100%	284
3-Sep	12%	8%	8%	7%	5%	1%	0%	1%	0%	1%	0%	0%	1%	0%	1%	1%	1%	2%	5%	2%	3%	7%	19%	17%	100%	363
1-Oct	2%	5%	4%	2%	2%	3%	2%	2%	3%	6%	7%	6%	3%	3%	3%	4%	3%	3%	2%	12%	7%	5%	5%	5%	100%	415
8-Sep	5%	4%	5%	3%	12%	12%	4%	5%	1%	1%	2%	1%	1%	3%	3%	2%	4%	3%	5%	5%	3%	5%	8%	4%	100%	446
30-Sep	2%	2%	4%	1%	1%	1%	2%	1%	6%	7%	2%	7%	2%	5%	6%	6%	3%	3%	20%	2%	5%	5%	6%	3%	100%	600
20-Sep	5%	3%	2%	2%	3%	2%	3%	1%	1%	4%	4%	3%	3%	2%	4%	2%	4%	4%	17%	2%	3%	5%	9%	13%	100%	710
26-Sep	2%	0%	1%	1%	4%	2%	0%	0%	3%	5%	10%	5%	3%	4%	3%	4%	3%	6%	5%	8%	15%	7%	3%	5%	100%	733
19-Sep	2%	2%	2%	1%	5%	2%	1%	1%	3%	3%	5%	5%	2%	5%	3%	5%	4%	3%	17%	2%	3%	4%	13%	8%	100%	748
25-Sep	1%	2%	2%	7%	5%	4%	3%	3%	1%	4%	3%	9%	1%	1%	2%	3%	4%	9%	4%	0%	8%	11%	8%	5%	100%	755
22-Sep	8%	3%	2%	2%	3%	2%	2%	2%	0%	3%	6%	5%	1%	3%	2%	15%	3%	3%	13%	2%	2%	2%	6%	10%	100%	878
21-Sep	0%	3%	2%	2%	3%	3%	3%	2%	2%	3%	0%	2%	1%	2%	2%	1%	3%	3%	23%	2%	6%	12%	11%	9%	100%	890
17-Sep	7%	2%	3%	4%	1%	3%	2%	3%	7%	4%	3%	5%	2%	4%	5%	4%	3%	7%	6%	3%	3%	4%	5%	7%	100%	925
24-Sep	3%	4%	2%	1%	2%	3%	3%	2%	2%	6%	2%	3%	2%	5%	3%	4%	3%	5%	8%	8%	10%	6%	9%	4%	100%	955
9-Sep	5%	4%	4%	3%	9%	7%	3%	7%	2%	3%	1%	1%	1%	3%	2%	1%	1%	2%	1%	2%	3%	2%	16%	17%	100%	1067
12-Sep	5%	7%	6%	5%	0%	0%	0%	2%	2%	3%	4%	3%	1%	2%	2%	2%	4%	5%	4%	7%	14%	9%	4%	7%	100%	1106
16-Sep	7%	4%	5%	2%	1%	3%	6%	3%	6%	3%	2%	5%	3%	5%	4%	7%	4%	1%	3%	7%	6%	4%	8%	2%	100%	1154
14-Sep	4%	5%	5%	4%	3%	3%	3%	2%	5%	3%	4%	4%	4%	5%	4%	4%	3%	3%	5%	5%	5%	5%	4%	10%	100%	1182
18-Sep	7%	4%	3%	0%	2%	3%	2%	3%	3%	7%	5%	3%	2%	3%	5%	4%	5%	3%	9%	2%	4%	4%	11%	7%	100%	1182
13-Sep	7%	6%	4%	4%	5%	3%	4%	5%	2%	3%	5%	4%	1%	2%	3%	8%	5%	3%	3%	2%	9%	4%	3%	5%	100%	1190
23-Sep	2%	2%	1%	1%	1%	2%	2%	1%	2%	5%	5%	5%	4%	2%	11%	7%	4%	9%	7%	1%	5%	7%	7%	6%	100%	1206
15-Sep	4%	8%	5%	6%	1%	3%	2%	2%	6%	2%	1%	3%	5%	4%	4%	6%	2%	5%	0%	2%	11%	5%	8%	5%	100%	1459
10-Sep	6%	9%	4%	5%	6%	3%	3%	2%	3%	2%	2%	2%	1%	2%	1%	1%	2%	2%	0%	0%	3%	15%	17%	9%	100%	1487
11-Sep	5%	4%	5%	7%	6%	4%	2%	4%	1%	1%	2%	3%	1%	1%	1%	4%	1%	0%	3%	6%	7%	12%	13%	7%	100%	1490
Average (a)	4%	4%	3%	3%	3%	3%	2%	2%	3%	4%	3%	4%	2%	3%	4%	5%	3%	4%	8%	3%	7%	7%	8%	7%		
st. dev. (a)	2%	2%	1%	2%	2%	1%	1%	1%	2%	2%	2%	2%	1%	1%	2%	3%	1%	3%	7%	3%	4%	4%	4%	4%		
st. dev. (b)	8%	5%	6%	4%	5%	3%	2%	2%	1%	2%	2%	2%	1%	2%	1%	1%	1%	2%	2%	4%	3%	3%	5%	10%		

Days on which passage of fish was completely halted for more than one hour are not included.
(a) only days on which more than 500 fish were counted are included.
(b) only days on which fewer than 500 fish were counted are included.

Appendix 4.0. Daily counts of chinook and coho salmon through the Fishing Branch River weir, 1997.

	Chinook				Coho			
Date	Daily Male	Daily Female	Daily Unknown	Daily Total	Daily Male	Daily Female	Daily Unknown	Daily Total
28-Aug				0				0
29-Aug				0				0
30-Aug			3	3				0
31-Aug			1	1				0
1-Sep				0				0
2-Sep			1	1				0
3-Sep				0				0
4-Sep				0				0
5-Sep				0				0
6-Sep				0				0
7-Sep			1	1				0
8-Sep			1	1				0
9-Sep			2	2				0
10-Sep			2	2				0
11-Sep				0				0
12-Sep				0				0
13-Sep	1			1				0
14-Sep				0				0
15-Sep				0				0
16-Sep				0				0
17-Sep				0				0
18-Sep				0				0
19-Sep				0				0
20-Sep				0				0
21-Sep				0				0
22-Sep				0				0
23-Sep				0				0
24-Sep				0				0
25-Sep				0				0
26-Sep				0				0
27-Sep				0				0
28-Sep				0				0
29-Sep				0				0
30-Sep				0				0
1-Oct				0				0
2-Oct				0				0
3-Oct				0				0
4-Oct				0				0
5-Oct				0				0
6-Oct				0				0
7-Oct				0				0
8-Oct				0	1			1
9-Oct				0	2			2
10-Oct				0				0
11-Oct				0			1	1
12-Oct				0			2	2
13-Oct				0				0
14-Oct				0			2	2
15-Oct				0				0
TOTALS	1	0	11	12	3	0	5	8

14-Sep	1 female	chinook	carcass	(drifted onto weir)
17-Sep	1 male	chinook	carcass	(drifted onto weir)

Appendix 5. Spaghetti Tags Observed at the Fishing Branch Weir, 1997

Date	White Male	White Female	White Unknown	Yellow Male	Yellow Female	Yellow Unknown
28-Aug						
29-Aug						
30-Aug						
31-Aug						
1-Sep				1		
2-Sep		4				
3-Sep						
4-Sep		2				
5-Sep			1			
6-Sep						
7-Sep		2				
8-Sep		1		1		
9-Sep		3	2			
10-Sep		3	4			
11-Sep		3	1			
12-Sep		4	2			
13-Sep		2	7	1		
14-Sep		5				
15-Sep		8	5			
16-Sep		7	2			
17-Sep		3	2			
18-Sep		3	5			
19-Sep			3			
20-Sep			1			
21-Sep		6	5			
22-Sep			1			
23-Sep		6	1			
24-Sep		6	1			
25-Sep		2	7		2	
26-Sep		6	1		1	1
27-Sep		4	1		1	
28-Sep			1		4	1
29-Sep					4	
30-Sep					5	2
1-Oct					1	3 2
2-Oct					1	1
3-Oct						1
4-Oct						
5-Oct		1				
6-Oct						
7-Oct						1
8-Oct					1	1
9-Oct					1	1
10-Oct						
11-Oct						
12-Oct						1
13-Oct						
14-Oct						
15-Oct						
Total		81	53	3	21	12 5

Appendix 5.1. Spaghetti Tags Recovered at the Fishing Branch Weir, 1997

TagID	Colour	Sex	Date Tagged	Date Recovered	Days Elapsed	Rate of Travel (c,d)
404	yellow	M	27-Aug	28-Sep	32.0	0.00
473	yellow	M	27-Aug	30-Sep	34.0	0.00
757	yellow	M	27-Aug	25-Sep	29.0	0.00
918	yellow	F	28-Aug	3-Oct	36.0	0.00
1036	yellow	M	28-Aug	27-Sep	30.0	0.00
1234	yellow	M	29-Aug	29-Sep	31.0	0.00
1249	yellow	F	29-Aug	1-Oct	33.0	0.00
1610	yellow	M	30-Aug	30-Sep	31.0	0.00
1695	yellow	F	30-Aug	2-Oct	33.0	0.00
1720	yellow	M	30-Aug	30-Sep	31.0	0.00
2155	yellow	F	1-Sep	1-Oct	30.0	0.00
3028	yellow	F	3-Sep	7-Oct	34.0	0.00
3117	yellow	F	3-Sep	8-Oct	35.0	0.00
3392	yellow	F	4-Sep	12-Oct	38.0	0.00
4693	yellow	M	8-Sep	9-Oct	31.0	0.00
11305	white	M	28-Jul	7-Sep	41.0	0.00
14601	white	M	6-Aug	14-Sep	39.0	0.00
14683	white	F	11-Aug	13-Sep	33.0	0.00
14911	white	M	11-Aug	15-Sep	35.0	0.00
15019	white	M	12-Aug	14-Sep	33.0	0.00
15316	white	M	12-Aug	14-Sep	33.0	0.00
15634	white	M	13-Aug	16-Sep	34.0	0.00
15687	white	M	13-Aug	17-Sep	35.0	0.00
15729	white	M	13-Aug	9-Sep	27.0	0.00
15854	white	M	14-Aug	15-Sep	32.0	0.00
15983	white	F	14-Aug	20-Sep	37.0	0.00
16308	white	?	15-Aug	13-Sep	29.0	0.00
16388	white	M	15-Aug	14-Sep	30.0	0.00
16395	white	M	15-Aug	27-Sep	43.0	0.00
16814	white	M	16-Aug	16-Sep	31.0	0.00
16990	white	F	16-Aug	15-Sep	30.0	0.00
17074	white	M	18-Aug	21-Sep	34.0	0.00
17804	white	M	19-Aug	16-Sep	28.0	0.00
18338	white	F	21-Aug	23-Sep	33.0	0.00
18767	white	F	22-Aug	25-Sep	34.0	0.00
19197	white	M	23-Aug	22-Sep	30.0	0.00
12749	white	F	1-Aug	5-Sep	35.0	0.00
17045 (a)	white	M	16-Aug	25-Sep	40.0	0.00
19253 (b)	white	F	23-Aug	7-Oct	45.0	0.00
882	yellow	M	28-Aug	29-Sep	32.0	0.00
1877	yellow	M	30-Aug	29-Sep	30.0	0.00
average:					33.4	0.0
maximum:					45.0	0.0
minimum:					27.0	0.0
std. dev					4.0	0.0

(a) post-spawn fish on upstream side of weir.
(b) mortality on upstream side of weir.
(c) kilometres per day.
(d) assumes that each fish resumed its migration immediately after tag application and was captured immediately upon arrival at the weir.

Appendix 5.2. Spaghetti Tag-Loss Study at the Fishing Branch Weir, 1997

Date	Fish Examined (b)	Fish Examined (c)	Total Fish Examined	Tags Observed (d)	Tag Loss
28-Aug	0	0	0		0
29-Aug	0	0	0		0
30-Aug	0	0	0		0
31-Aug	0	0	0		0
1-Sep	0	0	0		0
2-Sep	0	24	24		0
3-Sep	0	0	0		0
4-Sep	0	20	20		0
5-Sep	0	16	16	1	0
6-Sep	41	20	61		0
7-Sep	126	30	156	1	0
8-Sep	140	14	154		1 (e)
9-Sep	149	20	169	1	0
10-Sep	155	46	201		0
11-Sep	0	50	50		0
12-Sep	120	40	160		0
13-Sep	141	40	181	2	0
14-Sep	227	30	257	4	0
15-Sep	1029	30	1059	3	0
16-Sep	153	30	183	3	0
17-Sep	245	30	275	1	0
18-Sep	116	20	136		0
19-Sep	130	15	145		0
20-Sep	154	15	169	1	0
21-Sep	159	15	174	1	0
22-Sep	154	15	169	1	0
23-Sep	195	15	210	1	0
24-Sep	80	0	80		0
25-Sep	0	30	30	2	0
26-Sep	113	0	113		0
27-Sep	19	25	44	2	0
28-Sep	177	20	197	1	0
29-Sep	178	10	188	1	0
30-Sep	144	10	154	3	0
1-Oct	156	10	166	2	0
2-Oct	78	10	88	1	0
3-Oct	135	10	145	1	0
4-Oct	154	10	164		0
5-Oct	89	10	99		0
6-Oct	168	20	188		0
7-Oct	77	20	97	1	0
8-Oct	42	10	52	1	0
9-Oct	77	10	87	1	0
10-Oct	94	7	101		0
11-Oct	48	13	61		0
12-Oct	47	5	52	1	0
13-Oct	30	15	45		0
14-Oct	5	16	21		0
15-Oct	11	4	15		0
Total	5356	800	6156	37	1 (e)

(b) fish dip-netted for tag-loss examination purposes only.
(c) fish dip-netted for age-length-sex sampling *and* tag-loss examination purposes.
(d) does not include tags observed on fish that were not dip-netted.
(e) unconfirmed - tagging needle mark not documented.
* one fish with a severed pelvic fin was observed on September 14; however, the fin did not appear to have been clipped by humans and the fish lacked a tagging needle mark.

Appendix 6. Age composition of Fishing Branch River chum salmon by statistical week, 1997.

Males

Stat Week	Week Ending		Age Class 41	51	61	71	Weekly Sample	Weekly Count
35/36	6-Sep	N	7	30	5	0	42	1,149
			17%	71%	12%	0%		
		Expanded #	192	821	137	0		
			17%	71%	12%	0%		
37	13-Sep	N	28	65	11	0	104	3,806
			27%	63%	11%	0%		
		Expanded #	1,025	2,379	403	0		
			27%	63%	11%	0%		
38	20-Sep	N	16	31	6	1	54	3,698
			30%	57%	11%	2%		
		Expanded #	1,096	2,123	411	68		
			30%	57%	11%	2%		
39	27-Sep	N	14	5	2	0	21	2,879
			67%	24%	10%	0%		
		Expanded #	1,919	685	274	0		
			67%	24%	10%	0%		
40	4-Oct	N	15	8	0	0	23	1,201
			65%	35%	0%	0%		
		Expanded #	783	418	0	0		
			65%	35%	0%	0%		
41	11-Oct	N	8	15	0	0	23	300
			35%	65%	0%	0%		
		Expanded #	104	196	0	0		
			35%	65%	0%	0%		
42	18-Oct	N	8	1	1	0	10	30
			80%	10%	10%	0%		
		Expanded #	24	3	3	0		
			80%	10%	10%	0%		
Total		Expanded #	5,143	6,624	1,227	68	13,063	
			39%	51%	9%	1%	100%	

Females

Stat Week	Week Ending		Age Class 41	51	61	71	Weekly Sample	Weekly Count
35/36	6-Sep	N	3	17	1	0	21	1,053
			14%	81%	5%	0%		
		Expanded #	150	852	50	0		
			14%	81%	5%	0%		
37	13-Sep	N	14	72	5	0	91	3,253
			15%	79%	5%	0%		
		Expanded #	500	2,574	179	0		
			15%	79%	5%	0%		
38	20-Sep	N	35	41	1	0	77	3,662
			45%	53%	1%	0%		
		Expanded #	1,665	1,950	48	0		
			45%	53%	1%	0%		
39	27-Sep	N	19	18	6	0	43	3,313
			44%	42%	14%	0%		
		Expanded #	1,464	1,387	462	0		
			44%	42%	14%	0%		
40	4-Oct	N	17	18	2	0	37	1,870
			46%	49%	5%	0%		
		Expanded #	859	910	101	0		
			46%	49%	5%	0%		
41	11-Oct	N	35	9	1	0	45	694
			78%	20%	2%	0%		
		Expanded #	540	139	15	0		
			78%	20%	2%	0%		
42	18-Oct	N	16	11	0	0	27	60
			59%	41%	0%	0%		
		Expanded #	36	24	0	0		
			59%	41%	0%	0%		
Total		Expanded #	5,214	7,836	855	0	13,905	
			37%	56%	6%	0%	100%	

Appendix 6. (cont'd)

Sexes Combined

Stat Week	Week Ending		Age Class 41	51	61	71	Weekly Sample	Weekly Count
35/36	6-Sep	N	10	47	6	0	63	2,202
			16%	75%	10%	0%		
		Expanded #	350	1,643	210	0		
			16%	75%	10%	0%		
37	13-Sep	N	42	137	16	0	195	7,059
			22%	70%	8%	0%		
		Expanded #	1,520	4,959	579	0		
			22%	70%	8%	0%		
38	20-Sep	N	51	72	7	1	131	7,360
			39%	55%	5%	1%		
		Expanded #	2,865	4,045	393	56		
			39%	55%	5%	1%		
39	27-Sep	N	33	23	8	0	64	6,192
			52%	36%	13%	0%		
		Expanded #	3,193	2,225	774	0		
			52%	36%	13%	0%		
40	4-Oct	N	32	26	2	0	60	3,071
			53%	43%	3%	0%		
		Expanded #	1,638	1,331	102	0		
			53%	43%	3%	0%		
41	11-Oct	N	43	24	1	0	68	994
			63%	35%	1%	0%		
		Expanded #	629	351	15	0		
			63%	35%	1%	0%		
42	18-Oct	N	24	12	1	0	37	90
			65%	32%	3%	0%		
		Expanded #	58	29	2	0		
			65%	32%	3%	0%		
Total		Expanded #	10,253	14,583	2,076	56	26,968	
			38%	54%	8%	0%	100%	

Appendix 7. Fishing Branch River weir carcass sample, 1997.

Table 1. Sex composition of the chum salmon carcass sample, Fishing Branch River weir, 1997.

Stat Week	Week Ending	Male	Female	Total	% Female
40	4-Oct	9	1	10	10.0%
41	11-Oct	40	30	70	42.9%
42	18-Oct	31	19	50	38.0%
Total		80	50	130	38.5%

Table 2. Length composition by sex and age of the chum salmon carcass sample, Fishing Branch River weir, 1997.

Age	41		51		61		Combined	
Sex	Female	Male	Female	Male	Female	Male	Female	Male
N	15	33	32	41	2	6	50	80
Fork Length								
Ave	601	643	632	694	645	730	624	676
Max	565	550	590	550	620	710	565	550
Min	650	745	675	770	670	745	675	770
Var	605	1,448	514	2,303	1,250	220	768	2,602
Stdev	25	38	23	48	35	15	28	51
Post-Orbital Hypural (POH) Length								
Ave	498	516	527	553	530	569	519	539
Max	465	455	495	465	515	550	465	455
Min	535	635	565	605	545	580	565	635
Var	335	1,108	372	969	450	144	525	1,332
Stdev	18	33	19	31	21	12	23	37

Table 3. Age composition of the chum salmon carcass sample, Fishing Branch River weir, 1997.

Females						Males						Total	
41		51		61		41		51		61			
N	%	N	%	N	%	N	%	N	%	N	%	N	%
15	11.6%	32	24.8%	2	1.6%	33	25.6%	41	31.8%	6	4.7%	129	0.80

Appendix 8. Water temperature at Fishing Branch River weir 1997, degrees Celsius

Date/Time	2400	300	400	800	1200	1600	2000	2300
28-Aug					6.5	7.0	7.0	
29-Aug	7.0		6.0	6.0	6.0	7.0	7.5	
30-Aug	6.5		6.0	5.0	6.0	6.0	6.0	
31-Aug	5.5		5.0	6.0	5.5	6.0	6.0	
1-Sep	6.0		5.0	5.5	5.0	7.0	7.0	
2-Sep	6.0		5.0	5.0	5.0	6.0	6.5	
3-Sep	6.0		5.0	5.0	5.5	6.0	7.0	
4-Sep	6.5		3.0	3.5	4.5	5.5	6.0	
5-Sep	6.0		6.0	5.0	5.5	7.0	7.0	
6-Sep	5.5		5.0	5.0	6.0	6.0	6.0	
7-Sep	6.0		5.0	5.0	6.0	6.0	6.0	
8-Sep	6.0		5.0	5.0	5.0	6.0	6.0	
9-Sep	6.0		5.0	5.0	5.0	6.0	6.0	
10-Sep	5.5		5.0	5.0	5.0	7.0		6.0
11-Sep	5.5		5.5		6.0	6.5	6.0	
12-Sep	5.0		4.5	4.5	5.0	6.0	6.0	
13-Sep	5.0		4.5	4.5	5.0	5.5	6.0	
14-Sep	5.0		5.0	5.0	6.0	6.0		
15-Sep	5.0		5.0	5.0	5.0	5.5	6.0	
16-Sep	5.0		5.0	5.0	5.0	5.0	5.0	
17-Sep	5.0		4.5	5.0	5.0	5.0	6.0	
18-Sep	5.0		5.0	5.0	5.5	5.0	6.0	
19-Sep	5.0		4.0	4.0	4.5	5.0	5.5	
20-Sep	5.0		4.0	4.0	4.0	5.0	6.0	
21-Sep	4.0		4.0	4.0	4.0	5.0	5.0	
22-Sep	4.5		5.0	4.5	4.0	4.5	5.0	
23-Sep	4.0		4.0	4.0	4.5	5.0	5.0	
24-Sep	4.0		4.0	4.5	4.5	5.5	5.0	
25-Sep	5.0		4.0	4.0	5.0	5.5	5.0	
26-Sep	5.0		4.5	5.0	5.0	5.0	5.0	
27-Sep	5.0		4.5	4.0	5.0	5.0	5.0	
28-Sep	4.5		4.5	4.0	4.5	5.0	5.0	
29-Sep	4.5		4.0	4.0	4.5	5.5	4.0	
30-Sep	4.5		4.5	4.0	4.5	4.5	4.0	
1-Oct	4.5		4.5	4.0	4.0	4.5	4.5	
2-Oct	4.0			4.0	3.5	4.5	4.5	
3-Oct	3.5			4.0	4.0	4.0	4.0	
4-Oct	3.0			3.0	4.0	4.0	4.0	
5-Oct	3.0			3.5	3.5	4.5	4.0	
6-Oct	3.5			4.0	4.0	4.5	4.0	
7-Oct	3.0			3.0	2.5	3.0	3.0	
8-Oct	2.5			2.5	2.0	2.0	3.0	
9-Oct	3.0		3.0	3.0	3.5	4.0	3.5	
10-Oct	3.5		3.5	2.5	3.0	3.0	3.0	
11-Oct	3.0			2.0	2.5	2.5	2.5	
12-Oct	2.5			1.5	2.0	2.0	2.5	
13-Oct	2.5		2.0	2.0	2.0	2.0	2.5	
14-Oct	2.0	2.0		2.0	2.5	2.0	2.5	

Appendix 9. Water level at Fishing Branch River weir 1997, metres

Date/Time	2400	400	800	1200	1600	2000
28-Aug				0.00	0.00	0.00
29-Aug	0.00	0.00	0.00	0.00	0.00	0.00
30-Aug	0.00	0.00	0.00	0.00	0.00	0.00
31-Aug	0.00	0.00	0.00	0.00	0.00	0.00
1-Sep	0.00	0.00	0.00	0.00	0.00	0.00
2-Sep	0.00	0.00	0.00	0.00	0.00	0.00
3-Sep	0.00	0.00	0.00	0.00	0.00	0.00
4-Sep	0.00	0.00	0.00	0.00	0.00	0.00
5-Sep	0.00	0.00	0.00	0.00	0.00	0.00
6-Sep	0.00	0.00	0.00	0.00	0.00	0.00
7-Sep	0.00	0.00	0.00	0.00	0.00	0.00
8-Sep	0.00	0.00	0.00	0.00	0.00	0.00
9-Sep	0.00	0.00	0.00	0.00	0.00	0.00
10-Sep	0.00	0.00	0.00	0.00	0.00	
11-Sep	0.00	0.00		0.00	0.00	0.00
12-Sep	0.00	0.00	0.00	0.00	0.00	0.00
13-Sep	0.00	0.00	0.00	0.00	0.00	0.00
14-Sep	0.00	0.00	0.00	0.00	0.00	
15-Sep	0.00	0.00	0.00	0.00	0.00	0.00
16-Sep	0.00	0.00	0.00	0.00	0.00	0.00
17-Sep	0.00	0.00	0.00	0.00	0.00	0.00
18-Sep	0.00	0.00	0.00	0.00	0.00	0.00
19-Sep	0.00	0.00	0.00	0.00	0.00	0.00
20-Sep	0.00	0.00	0.00	0.00	0.00	0.00
21-Sep	0.00	0.00	0.00	0.00	0.00	0.00
22-Sep	0.00	0.00	0.00	0.00	0.00	0.00
23-Sep	0.00	0.00	0.00	0.00	0.00	0.00
24-Sep	0.00	0.00	0.00	0.00	0.00	0.00
25-Sep	0.00	0.00	0.00	0.00	0.00	0.00
26-Sep	0.00	0.00	0.00	0.00	0.00	0.00
27-Sep	0.00	0.00	0.00	0.00	0.00	0.00
28-Sep	0.00	0.00	0.00	0.00	0.00	0.00
29-Sep	0.00	0.00	0.00	0.00	0.00	0.00
30-Sep	0.00	0.00	0.00	0.00	0.00	0.00
1-Oct	0.00	0.00	0.00	0.00	0.00	0.00
2-Oct	0.00		0.00	0.00	0.00	0.00
3-Oct	0.00		0.00	0.00	0.00	0.00
4-Oct	0.00		0.00	0.00	0.00	0.00
5-Oct	0.00		0.00	0.00	0.00	0.00
6-Oct	0.00		0.00	0.00	0.00	0.00
7-Oct	0.00		0.00	0.00	0.00	0.00
8-Oct	0.00		0.00	0.00	0.00	0.00
9-Oct	0.00	0.00	0.00	0.00	0.00	0.00
10-Oct	0.00	0.00	0.00	0.00	0.00	0.00
11-Oct	0.00		0.00	0.00	0.00	0.00
12-Oct	0.00		0.00	0.00	0.00	0.00
13-Oct	0.00	0.00	0.00	0.00	0.00	0.00
14-Oct	0.00	0.00	0.00	0.00	0.00	0.00

Appendix 10. Annual counts of Fishing Branch River salmon, 1971 – 1997.

Year	Chum [a,b]	Chinook [h]	Coho [h]
1971	312,800	0 [b]	6 [b]
1972	35,125 [c]	1	0
1973	15,989 [d]	3	6
1974	32,525 [d]	2	0
1975	353,282 [d]	3	0
1976	36,584		
1977	88,400		
1978	40,800		
1979	119,898		
1980	55,268		
1981	57,386 [e]		
1982	15,901		
1983	27,200		
1984	15,150		
1985	56,016 [d]	3	0
1986	31,723 [d]	4	0
1987	48,956 [d]	0	6
1988	23,597 [d]	3	0
1989	43,834 [d]	6	12
1990	35,000 [f]		
1991	37,733 [d]	6	23
1992	22,517 [d]	1	0
1993	28,707 [d]	2	0
1994	65,247 [d]	23	100
1995	51,971 [d,g]	7	112
1996	77,200 [d]	4	12
1997	26,968 [d]	12	8

[a] Total escapement estimated using weir to aerial survey expansion factor of 2.72, unless otherwise indicated.
[b] Aerial survey count unless otherwise indicated.
[c] Weir installed on September 22. Estimate consists of a weir count of 17,190 after September 22, and a tagging passage estimate of 17,935 prior to weir installation.
[d] Weir count.
[e] Initial aerial survey count was doubled before applying the weir/aerial expansion factor of 2.72 since only half of the spawning area was surveyed.
[f] Weir was not operated. Although only 7,541 chum salmon were counted on a single survey flown October 26, a population estimate of approximately 27,000 fish was made through date of survey, based upon historic average aerial-to-weir expansion of 28%. Actual population of spawners was reported by DFO as between 30,000-40,000 fish considering aerial survey timing.
[g] Incomplete count due to late installation and/or early removal of project or high water events.
[h] Weir counts unless otherwise indicated.